PATENT ABSTRACTS OF JAPAN

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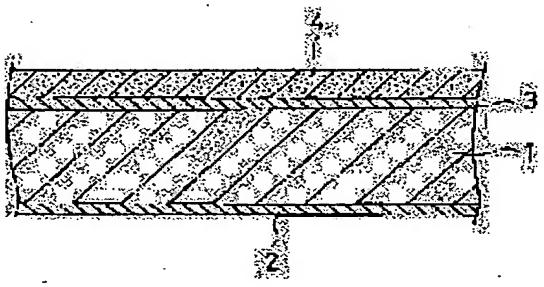
(54) COATED STEEL SHEET FOR EXTERIOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a coated steel sheet for exterior which can cover up insufficient characteristics of a fluoroplastic coated steel sheet, such as faults of being impaired or pressure-marked easily or tending to cause ice or the like to slip down, in particular, while it is capable of ensuring such characteristics as resistances to weather, corrosion, chemicals and heat that the fluoroplastic coated steel sheet has.
SOLUTION: An Al-Zn alloy plated steel sheet of 5-65 wt.% being used as a base, a resin coating blended with a rustproof pigment is baked to coat the surface side of the base so that the thickness of a dry coat is 1-5 μm, and thereby a prime coat layer is formed. A topcoat layer is formed on the prime coat layer. As for the resin coating for the topcoat layer, an acrylic resin coating of 18-120 pts.wt. is blended in a fluoroplastic coating of 100 pts.wt. and further ceramic fibers of 0.5-30 pts.wt. to 100 pts.wt. of the blended resin coating is blended with this resin coating. The resin coating of the topcoat layer is baked for coating so that the thickness of the dry coat is 7-19 μm.



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CLAIMS

[Claim(s)]
[Claim 1] An aluminum-Zn alloy-plating steel plate is used as a substrate five to 65% of the weight by which surface treatment was carried out. Carry out baking finish of the plastic paint which blended the rust preventive pigment with the front-face side of this substrate so that dry film thickness may be set to 1-5 micrometers, and the under coat is formed. Finishing coat is formed on this under coat. The plastic paint of that finishing coat 18-120 weight section combination of the acrylic resin system coating is carried out to the fluororesin system coating 100 weight section. Further to this combination plastic paint It is the paint steel plate for sheathing which is carrying out 0.5-30 weight section combination of the ceramic fiber to the plastic paint 100 weight section, and is characterized by carrying out baking finish of the plastic paint of said finishing coat so that dry film thickness may be set to 7-19 micrometers.
[Claim 2] The paint steel plate for sheathing according to claim 1 said whose substrate is a 45 - 65-% of the weight aluminum-Zn alloy-plating steel plate.
[Claim 3] The paint steel plate for sheathing according to claim 1 or 2 with which the acrylic resin system coating of said finishing coat has blended thermosetting acrylics and thermoplastic acrylic resin at ten to 90:90 - 10 % of the weight.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the paint steel plate for sheathing used for building materials, such as a roof and a wall.
[0002]
[Description of the Prior Art] As this kind of a paint steel plate for sheathing, there is a fluoropolymer painting steel plate (a coating is 80% or more fluororesin principal component), and compared with the steel plate which painted other plastic paint, this fluoropolymer painting steel plate has weatherability, corrosion resistance, chemical resistance, and thermal resistance, and fits the building material.
[0003]
[Problem(s) to be Solved by the Invention] However, a fluororesin coating is expensive, and since dry film thickness is moreover usually set as film thickness thick in 25-30 micrometers and a paint steel plate, it causes cost quantity of a fluoropolymer painting steel plate. Moreover, since a fluororesin paint film is a flexible paint film, a blemish tends to produce it at the time of processing. Moreover, since the front face is smooth, it is easy to slide down snow and ice, and a blemish may arise on the fluororesin paint film front face after [this] sliding down. If the blemish arose, moisture (acid rain, acid snow, acid fog) tended to permeate on the surface of the metal plate, for example, when a metal plate was a galvanized steel sheet, the phenomenon in which the zinc ion of a plating side begins to melt through a paint film, and a paint film was broken by it arose, and it has left the problem to corrosion resistance. Moreover, since the fluororesin paint film front face was not so hard, a pressure mark etc. tended to be attached.
[0004] The purpose of this invention is by adding an improvement to a fluoropolymer painting steel plate to offer the paint steel plate for sheathing which secures weatherability, corrosion resistance, chemical resistance, and thermal resistance, and can aim at antislip nature, such as a sex with a blemish-proof, abrasion resistance, and ice, and further corrosion resistance improvement with profit.
[0005]
[Means for Solving the Problem] The paint steel plate for sheathing of this invention uses an aluminum-Zn alloy-plating steel plate as a substrate five to 65% of the weight by which surface treatment was carried out. Carry out baking finish of the plastic paint which blended the rust preventive pigment with the front-face side of this substrate so that dry film thickness may be set to 1-5 micrometers, and an under coat is formed. Finishing coat is formed on this under coat. The plastic paint of that finishing coat 18-120 weight section combination of the acrylic resin system coating is carried out to the fluororesin system coating 100 weight section. Further to this combination plastic paint It has the description to carry out [are carrying out 0.5-30 weight section combination of the ceramic fiber to the plastic paint 100 weight section, and] baking finish of the plastic paint of said finishing coat so that dry film thickness may be set to 7-19 micrometers.
[0006] In this case, it is more desirable to use an aluminum-Zn alloy-plating steel plate for the above-mentioned substrate 45 to 65% of the weight. Moreover, it is more desirable to use what blended thermosetting acrylics and thermoplastic acrylic resin at ten to 90:90 - 10 % of the weight for the acrylic resin system coating of the above-mentioned finishing coat.
[0007]
[Function] Since the paint steel plate for sheathing of the above-mentioned configuration has little elution of the zinc ion from the plating layer which is excellent in thermal resistance compared with a galvanized steel sheet, and lets a paint film pass since the aluminum-Zn alloy-plating steel plate is used as the substrate five to 65% of the weight, it excels also in corrosion resistance. In less than 5% of the weight of an aluminum-Zn alloy-plating steel plate, thermal resistance and corrosion resistance cannot fully be expected. The corrosion resistance of a shear end face falls in the aluminum-Zn alloy-plating steel plate exceeding 65 % of the weight.

[0008] By having blended ceramic fiber and acrylic resin with finishing coat, a blemish, a pressure mark, etc. at the time of processing stop being attached easily, and abrasion resistance can be given. Since finishing coat is using the fluororesin as the principal component, chemical resistance is also securable.
[0009] By making a finishing paint film front face coarse by combination of ceramic fiber, it is hard coming to slide down ice etc. and can prevent with [this / that is depended for sliding down] a blemish.
[0010] The dry film thickness of finishing coat can aim at reduction of paint cost by making thin dry film thickness of 7-19 micrometers and an under coat with 1-5 micrometers.
[0011] When thermosetting acrylics is blended with the acrylic resin system coating of finishing coat, degradation of a fluororesin with the passage of time can be controlled. Moreover, the cost can be cut down if it is made the low fluororesin coating which lowered the loadings of the fluororesin to acrylic resin in finishing coat.
[0012]
[Embodiment of the Invention] The suitable operation gestalt of the paint steel plate for sheathing of this invention is explained.
[0013] The paint steel plate for sheathing concerning this invention forms an under coat in the front-face side of a substrate, and forms finishing coat on this under coat. An aluminum-Zn alloy-plating steel plate is used for the above-mentioned substrate five to 65% of the weight. In less than 5% of the weight of an aluminum-Zn alloy-plating steel plate, thermal resistance and corrosion resistance cannot fully be expected, but the corrosion resistance of a shear end face falls in the aluminum-Zn alloy-plating steel plate exceeding 65 % of the weight. For this reason, an aluminum-Zn alloy-plating steel plate is used 45 to 65% of the weight more preferably.
[0014] In forming a plating layer in a steel plate by making Si contain more than the 0.5 weight section to aluminum content in an alloy-plating layer in an aluminum-Zn alloy-plating steel plate five to 65% of the weight, it can control that the weak iron content alloy layer in an interface with a steel plate surface alloy plating is formed, and the adhesion of a steel plate and a plating layer can be raised. If the loadings of Si make 10 weight sections an upper limit and it is exceeded, they will cause the fall of the workability of a plating layer. Moreover, it can control more effectively that zinc will be eluted from an alloy-plating layer under a corrosive ambient atmosphere in an alloy-plating layer if 1.0-5.0 weight section combination of Mg is carried out. If [than the 5.0 weight sections] more [said effectiveness is thin when there are few loadings of Mg than the 1.0 weight section, and], a degree of hardness will become high and workability will worsen.
[0015] Although an under coat is formed in the front-face side of a substrate, before painting this under coat, surface treatment, such as chromate treatment, is beforehand performed to a substrate. The coating which uses epoxy system resin, polyester system resin, acrylic resin, urethane system resin, etc. as a principal component is used for the plastic paint of an under coat. It blends a rust preventive pigment with the above-mentioned resin, and secures corrosion resistance while baking finish of the under coat is carried out thinly and it plans low cost so that dry film thickness may be set to 1-5 micrometers. If dry film thickness is thinner than 1 micrometer, corrosion resistance and adhesion will become low, and if thicker than 5 micrometers, it will become paint cost quantity. Although rust preventive pigments may be zinc chromate, strontium chromate, etc., if an environmental problem is taken into consideration, a metallic flake pigment like the zinc powder of non chromium and an aluminium powder, an ion-exchange nature pigment like calcium-silica, soluble colors like phosphate or molybdate, etc. are good. The loadings of a rust preventive pigment are 5 - 50 weight section to the above-mentioned resin 100 weight section. In addition, whenever [printing board temperature / of an under coat 2] is 180-240 degrees.
[0016] The plastic paint of the finishing coat by which baking finish is carried out on an under coat is a coating which uses as a principal component what blended acrylic resin to the fluororesin. Acrylic resin is compensated with the ease of getting damaged of the fluororesin at the time of processing. Fluororesins are polyvinylidene fluoride resin, polyvinyl fluoride, etc. Since the property which a fluororesin has will diminish if [than the 120 weight sections] more [the above-mentioned workability effectiveness is inferior to the fluororesin 100 weight section when there are few loadings of acrylic resin than 18 weight sections, and], what carried out 18-120 weight section combination of the acrylic resin to the fluororesin 100 weight section is desirable, and is 25 - 50 weight section more preferably.
[0017] If it is made what was blended with thermosetting acrylics with the work which controls especially degradation of a fluororesin with the passage of time 100% although you may be thermoplastic acrylic resin, acrylic resin coating becomes the degradation prevention at the time of processing and is advantageous even if the storage time as a paint steel plate serves as a long period of time. Thermosetting acrylics serves as the molecular structure hardened in after [baking finish] three dimensions, this molecular structure passes through it and it cannot be easily influenced in the time, will control the crystal growth of a fluororesin, will maintain a small crystal, and inhibits degradation of a fluororesin with the passage of time. Moreover, since thermosetting acrylics raises the degree of hardness of a finishing paint film, it serves to mitigate generating of a blemish and

the pressure mark at the time of press working of sheet metal. The mixed ratio of thermosetting acrylics and thermoplastic acrylic resin is made into ten to 90:90 - 10 % of the weight. this mixing ratio -- a rate -- being out of range -- if -- the above-mentioned workability and a fluororesin -- the function of both degradation prevention with the passage of time is not fully obtained. A more desirable mixed ratio is 40 to 60:60 - 40 % of the weight.

[0018] 0.5-30 weight section combination of the ceramic fiber is carried out to the resin solid content 100 weight section at the combination plastic paint of a fluororesin system coating and an acrylic resin system coating. Ceramic fiber uses an alumina, a silica, a zirconia, etc. as a principal component. The die length of 2-5 micrometers and ceramic fiber of the diameter of ceramic fiber is 5-150 micrometers. While such ceramic fiber raises the sex with a blemish-proof of a finishing paint film, and pressure-proof mark nature, since it makes a finishing paint film front face coarse, ice etc. stops being able to slide on it easily. Ice etc. is made hard to set to Ra=0.5-2.5micrometer and Rmax=10-30micrometer the roughness of the finishing paint film front face which blended ceramic fiber, and to slide. If there are few loadings of ceramic fiber than the 0.5 weight section, it will fully be hard coming to obtain the above-mentioned effectiveness, and if [than 30 weight sections] more, the elongation of a finishing paint film will fall extremely and bending workability will worsen. The loadings of more desirable ceramic fiber are 0.5 - 3 weight section.

[0019] Dry film thickness of finishing coat is set to 7-19 micrometers. In less than 7 micrometers, depending on paint color, concealment nature is inferior, and if 19 micrometers is exceeded, it will become a paint cost rise. The dry film thickness of more desirable finishing coat is 13-17 micrometers. Adopting roll coating as paint of top coat, whenever [printing board temperature] is 220-280 degrees.

[0020] If scale-like aluminium powder, mica powder, etc. are blended, it can give adiathermic to top coat. The these scale-like matter carries out 2-60 weight section combination to the coating 100 weight section. If there are few loadings of the scale-like matter than 2 weight sections, adiabatic efficiency is not expectable, and if [than 60 weight sections] more, the adhesion of a finishing paint film will fall. As for especially the magnitude of the scale-like matter, it is desirable that it is 20 micrometers or less 50 micrometers or less. The scale-like matter is well located in a line with a finishing paint film side and parallel as it is 20 micrometers or less, and while corrosion resistance improves by this, adiabatic efficiency also improves. If 50 micrometers is exceeded, when the scale-like matter is not level located in a line with a finishing paint film side, adiabatic efficiency and corrosion-resistant effectiveness will decrease.

[0021] Baking finish of the coating which uses a polyester resin system, an epoxy resin system, an acrylic resin system, a urethane resin system, etc. as a principal component is carried out to the rear-face side of a substrate. Strontium chromate etc. may be blended with this rear-face coating as a rust preventive pigment. The dry film thickness of this rear-face coating is 1-10 micrometers. In addition, this rear-face paint is good as for two quart.

[0022]

[Example] The cross-section structure of the paint steel plate applied to the example of this invention at example 1 drawing 1 is shown typically. The 55-% of the weight aluminum-Zn alloy hot-dipping steel plate (henceforth a steel plate 1) of 0.4mm thickness by which chromate treatment was carried out as a substrate 1 is used. The predetermined flesh-side paint layer 2 is formed in the rear face of a steel plate 1.

[0023] An under coat 3 is formed in the front face of a steel plate 1. The under coat 3 was painted with a roll, could be burned at 200 degrees of board temperature C, dried the polyester system plastic paint which comes to carry out 30 weight sections combination of the rust preventive pigment zinc chromate to the coating 100 weight section, and it formed it so that it might become the dry film thickness of 4 micrometers.

[0024] Finishing coat 4 is formed on an under coat 3. As for the plastic paint of finishing coat 4, 80 weight sections combination of the acrylic resin was carried out to the fluororesin 100 weight section, and this acrylic resin is blended at a rate of thermoplastic acrylic resin:thermosetting acrylics =3:2. Furthermore, 1.9 weight section combination of the ceramic fiber is carried out into the paint film at the plastic paint of this finishing coat 4. Besides, it paints by the roll coater, can be burned by 250-degreeC, and dries, and the plastic paint of a coat 4 is formed so that dry film thickness may be set to 15 micrometers.

[0025] Next, drawing 2 is made reference and an example of the manufacture approach of the paint steel plate of the above-mentioned configuration is explained. The end of the long steel plate 1 rolled in the shape of a roll is pulled out, it leads to the pretreatment section 11, and predetermined surface treatment, such as cleaning, washing, and chromate treatment, is performed to a steel plate 1 in this pretreatment section 11. Subsequently, after leading the steel plate 1 after this pretreatment to the under coat paint section 12 and the rear-face paint section 13 one by one, and applying the polyester system plastic paint for under coat formation mentioned above on the front face of a steel plate 1 and performing flesh-side paint at the rear face of a steel plate 1, the under coat 3 with a dry film thickness [like drawing 1] of 4 micrometers and the predetermined flesh-side paint layer

2 are formed by being burned at 200 degrees of board temperature C in the 1st printing furnace 14, and drying. Furthermore, by leading this steel plate 1 to the finishing paint section 15, applying the coating for finishing coat formation mentioned above on said under coat 3, being burned at 250 degrees of board temperature C in the 2nd printing furnace 16, and drying, finishing coat 4 with a dry film thickness [like drawing 1] of 15 micrometers is formed, and, finally it rolls round in the shape of a roll.

[0026] It is the same as an example 1 except example of comparison 1 under coat being the polyester system resin paint film which is the dry film thickness of 7 micrometers, and being the fluororesin system paint film (80 % of the weight of fluororesins) whose finishing coat is the dry film thickness of 25 micrometers.

[0027] It is the same as an example 1 except example of comparison 2 under coat being the polyester system resin paint film which is the dry film thickness of 8 micrometers, and being the polyester system resin paint film whose finishing coat is the dry film thickness of 15 micrometers.

[0028] The slipping sex test of the ice about the paint steel plate of an example 1 and the examples 1 and 2 of a comparison, a taper abrasion test, a pressure mark trial, the chemical sex test, and the CAS (corrosion resistance) trial were carried out in the following way.

[0029] (1) Water was sprayed on the icy slipping sex-test test piece, ice was placed, and it was made to freeze for 2 hours. The time amount into which 20 degrees of test pieces are made to incline, they are put in a place with a room temperature [C] of 20 degrees, and ice slides this down was measured.

(2) It examined by the taper abrasion test [JIS K5400 8.9 (abrasion resistance)]. A taper form wear ring adds 9.81 Ns (1.0Kgf) of loads using CS10.

(3) It carried out by uniting front flesh-side paint films on condition that pressure-proof mark 20kg [/cm] trial 2x24-hour x40-degreeC.

(4) The water solution and 5%H2 SO4 of 5% of chemical corrosion resistance tests NaOH It was immersed in the water solution for 240 hours, respectively, and the degree of discoloration of a paint film was seen.

(5) CAS (corrosion resistance) trial JIS [JIS H8681 5. (the CASS test approach)] It judged in the RN (R. N) standard graph by viewing of the attached chart 1 of H8681.

[0030] The result of test-result each trial is as being shown in the graph of drawing 3 . finishing coat -- the combination coating of a fluororesin system coating and an acrylic resin system coating (mixture of thermoplastic acrylic resin and thermosetting acrylics) -- and it turns out that finishing coat excels [paint film / the fluororesin system paint film or / polyester resin system] in the example 1 which carried out specified quantity addition of the ceramic fiber especially at icy skid nature, abrasion resistance, and pressure-proof mark nature as compared with the examples 1 and 2 of a comparison which do not add ceramic fiber -- I will come out.

[0031] It is the same as an example 1 except having used the aluminum-Zn alloy-plating steel plate for the substrate 6% of the weight, and having used the acrylic resin of finishing coat as thermoplastic acrylic resin 100% in the two to example 4 example 2. It is the same as an example 1 except having used the aluminum-Zn alloy-plating steel plate for the substrate 6% of the weight in the example 3, and having made the mixed ratio of thermoplastic acrylic resin and thermosetting acrylics into 60:40 % of the weight as acrylic resin of finishing coat. It is the same as an example 1 except having used the aluminum-Zn alloy-plating steel plate for the substrate 6% of the weight in the example 4, and having made the mixed ratio of thermoplastic acrylic resin and thermosetting acrylics into 40:60 % of the weight as acrylic resin of finishing coat.

[0032] As a deterioration test of the paint steel plate of examples 2-4 with the passage of time, more than was investigated in the no crack T after performing a promotion weatherability trial for six days in the ambient atmosphere of no more than [early] (bending workability) and early (immediately after paint) Crack T, and 60-degreeC. This test result is as being shown in drawing 4 . It turns out that the example 2 for which the examples 3 and 4 which blended thermoplastic acrylic resin and thermosetting acrylics use thermoplastic acrylic resin 100% as acrylic resin of finishing coat is excelled in the suppression effectiveness of degradation of finishing coat with the passage of time.

[0033]

[Effect of the Invention] According to this invention, being able to secure properties, such as the weatherability of a fluoropolymer painting steel plate, corrosion resistance, chemical resistance, and thermal resistance, the property which the steel plate runs short of especially a blemish, a pressure mark, etc. tend to be attached, and there is an advantage that the paint steel plate for sheathing with which a fault, such as being easy to slide down ice etc., is suppliable can be offered by low cost.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing typically the paint steel plate for sheathing concerning the example of this invention.
[Drawing 2] It is the production process Fig. of the paint steel plate metal plate for sheathing.
[Drawing 3] It is the graph showing the result of the slipping sex test of the ice about an example 1 and the examples 1-2 of a comparison, a taper abrasion test, a pressure mark trial, the chemical sex test, and a CASS test.
[Drawing 4] It is the graph showing the result of the deterioration test with the passage of time about examples 2-4.
[Description of Notations]
1 Substrate
2 Flesh-Side Paint Layer
3 Under Coat
4 Finishing Coat

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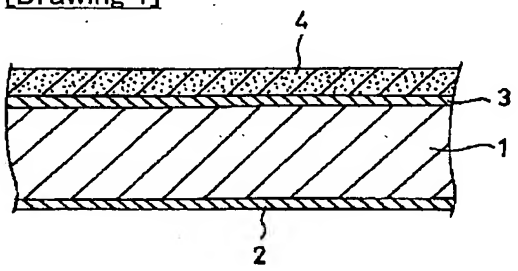
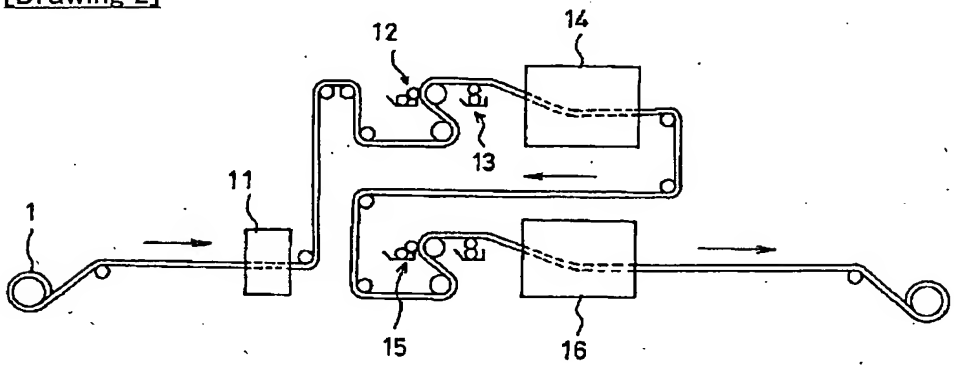
DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 4]

	実施例2	実施例3	実施例4
初期（塗装直後）	3T	3T	4T
テスト(6日間) 後	7T	5T	6T

[Drawing 3]

	実施例１	比較例１	比較例２
(1) 水の滑り性試験	15分経過滑らない	6分13秒	8分 2秒
表面粗さＲａ	1.9μm	0.3μm	0.2μm
〃 Ｒmax	24.4 μm	5.1μm	4.3μm
(2) テーパー摩耗試験 減摩量(mg)	14.7	19.6	24.5
(3) 耐プレッシャマーク性	異常なし	プレッシャマーク大 目視確認	プレッシャマーク中 見る角度によりよく目立つ
(4) 薬品性変色試験			
5%NaOH	変色極小	変色極小	変色大（目視確認）
5%H_2SO_4	変色〃	変色〃	変色大（目視確認）
(5) キャス試験（耐食性試験）	ＲＮ9.8 以上 異常なし	ＲＮ9.8 以上 異常なし	ＲＮ8 全面ブリスター発生

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
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審査請求　未請求　請求項の数３　ＯＬ　（全　６　頁）

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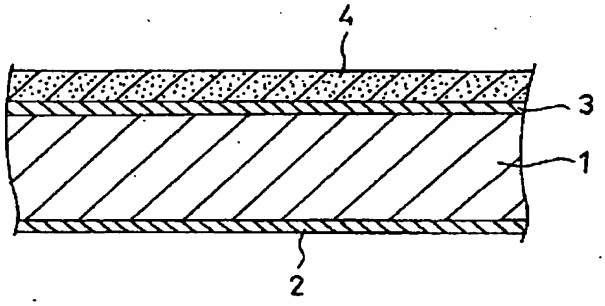
最終頁に続く

(54)【発明の名称】　外装用塗装鋼板

(57)【要約】
【課題】　フッ素樹脂塗装鋼板の耐候性、耐食性、耐薬品性、耐熱性等の特性を確保し得えながら、その鋼板に不足している特性、特に傷やプレッシャマーク等が付き易く、また氷等が滑り落ち易いなどの欠点を補うことのできる外装用塗装鋼板を提供する。
【解決手段】　５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を基板とし、この基板の表面側に防錆顔料を配合した樹脂塗料を乾燥塗膜厚が１～５μｍとなるように焼付塗装して下塗り層を形成する。この下塗り層の上には上塗り層を形成する。上塗り層の樹脂塗料は、フッ素樹脂系塗料１００重量部に対してアクリル樹脂系塗料を１８～１２０重量部配合し、更にこの配合樹脂塗料に、樹脂塗料１００重量部に対してセラミックファイバーを０．５～３０重量部配合する。上塗り層の樹脂塗料は乾燥塗膜厚が７～１９μｍとなるように焼付塗装される。



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【特許請求の範囲】
【請求項１】　表面処理された５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を基板とし、この基板の表面側に防錆顔料を配合した樹脂塗料を乾燥塗膜厚が１～５μｍとなるように焼付塗装して下塗り層を形成しており、
この下塗り層の上には上塗り層が形成されており、その上塗り層の樹脂塗料は、フッ素樹脂系塗料１００重量部に対してアクリル樹脂系塗料を１８～１２０重量部配合しており、更にこの配合樹脂塗料には、樹脂塗料１００重量部に対してセラミックファイバーを０．５～３０重量部配合しており、
前記上塗り層の樹脂塗料は乾燥塗膜厚が７～１９μｍとなるように焼付塗装されていることを特徴とする、外装用塗装鋼板。
【請求項２】　前記基板が、４５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板である、請求項１記載の外装用塗装鋼板。
【請求項３】　前記上塗り層のアクリル樹脂系塗料が、熱硬化性アクリル樹脂と熱可塑性アクリル樹脂を１０～９０：９０～１０重量％で配合している、請求項１又は２記載の外装用塗装鋼板。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、屋根や壁等の建築材料に用いられる外装用塗装鋼板に関する。
【０００２】
【従来の技術】この種の外装用塗装鋼板として、フッ素樹脂塗装鋼板（塗料は８０％以上フッ素樹脂主成分）があり、このフッ素樹脂塗装鋼板は、その他の樹脂塗料を塗装した鋼板に比べて、耐侯性、耐食性、耐薬品性、耐熱性があり、建築材料に適している。
【０００３】
【発明が解決しようとする課題】しかし、フッ素樹脂塗料は高価で、しかも乾燥塗膜厚が通常２５～３０μｍと塗装鋼板の中では厚い塗膜厚に設定されているため、フッ素樹脂塗装鋼板のコスト高の原因となっている。また、フッ素樹脂塗膜は柔軟な塗膜であるため、加工時に傷が生じやすく、また表面が滑らかであるので雪や氷が滑り落ちやすく、この滑り落ちた後のフッ素樹脂塗膜表面に傷が生じることがあり、もし傷が生じると水分（酸性雨、酸性雪、酸性霧）が金属板の表面に浸透しやすく、例えば、金属板が亜鉛めっき鋼板の場合は、塗膜を通してめっき面の亜鉛イオンが溶け出し、それによって塗膜が破られるという現象が生じ、耐食性に問題を残している。また、フッ素樹脂塗膜表面はあまり硬くないので、ブレッシャマーク等も付きやすかった。
【０００４】本発明の目的は、フッ素樹脂塗装鋼板に改善を加えることにより耐侯性、耐食性、耐薬品性、耐熱性を確保し得ながら耐傷付き性、耐摩耗性、氷等の滑止め性、耐食性の更なる向上を図れる外装用塗装鋼板を提供することにある。

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【０００５】
【課題を解決するための手段】本発明の外装用塗装鋼板は、表面処理された５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を基板とし、この基板の表面側に防錆顔料を配合した樹脂塗料を乾燥塗膜厚が１～５μｍとなるように焼付塗装して下塗り層を形成し、この下塗り層の上には上塗り層を形成しており、その上塗り層の樹脂塗料は、フッ素樹脂系塗料１００重量部に対してアクリル樹脂系塗料を１８～１２０重量部配合しており、更にこの配合樹脂塗料には、樹脂塗料１００重量部に対してセラミックファイバーを０．５～３０重量部配合しており、前記上塗り層の樹脂塗料は乾燥塗膜厚が７～１９μｍとなるように焼付塗装していることに特徴を有するものである。
【０００６】この場合において、上記基板には、４５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を使用することがより好ましい。また、上記上塗り層のアクリル樹脂系塗料には、熱硬化性アクリル樹脂と熱可塑性アクリル樹脂を１０～９０：９０～１０重量％で配合したものを使用することがより好ましい。
【０００７】
【作用】上記構成の外装用塗装鋼板は、５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を基板としているので、亜鉛めっき鋼板に比べて耐熱性に優れ、また塗膜を通してのめっき層からの亜鉛イオンの溶出が少ないため耐食性にも優れる。５重量％未満のＡｌ－Ｚｎ合金めっき鋼板では耐熱性、耐食性を十分に期することができない。６５重量％を越えるＡｌ－Ｚｎ合金めっき鋼板では、剪断端面の耐食性が低下する。
【０００８】上塗り層にセラミックファイバーとアクリル樹脂を配合していることで、加工時の傷やブレッシャマーク等が付きにくくなり、耐摩耗性を付与することができる。上塗り層はフッ素樹脂を主成分としているので、耐薬品性も確保できる。
【０００９】セラミックファイバーの配合で上塗り塗膜表面を粗くすることにより氷等が滑り落ちにくくなり、この滑り落ちによる傷付きを防止できる。
【００１０】上塗り層の乾燥塗膜厚は７～１９μｍ、下塗り層の乾燥塗膜厚は１～５μｍと薄くすることにより塗装コストの低減を図れる。
【００１１】上塗り層のアクリル樹脂系塗料に熱硬化性アクリル樹脂を配合しておくと、フッ素樹脂の経時劣化を抑制できることになる。また、上塗り層においてアクリル樹脂に対するフッ素樹脂の配合量を下げた低フッ素樹脂塗料にすれば、コストダウンすることができる。
【００１２】
【発明の実施の形態】本発明の外装用塗装鋼板の好適な実施形態を説明する。
【００１３】本発明に係る外装用塗装鋼板は基板の表面側に下塗り層を形成し、この下塗り層の上に上塗り層を

形成する。上記基板には５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を用いる。５重量％未満のＡｌ－Ｚｎ合金めっき鋼板では耐熱性、耐食性を十分に期することができず、６５重量％を越えるＡｌ－Ｚｎ合金めっき鋼板では剪断端面の耐食性が低下する。このため、より好ましくは４５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板を用いる。

【００１４】５～６５重量％Ａｌ－Ｚｎ合金めっき鋼板において、合金めっき層中に、Ａｌ含有量に対してＳｉを０．５重量部以上含有させることにより、鋼板にめっき層を形成するにあたり、鋼板表面合金めっきとの界面における、もろい鉄含有合金層が形成されるのを抑制できて、鋼板とめっき層との密着性を向上させることができる。Ｓｉの配合量は１０重量部を上限とし、それを越えるとめっき層の加工性の低下を招く。また、合金めっき層にＭｇを１．０～５．０重量部配合すれば、腐食性雰囲気下において、合金めっき層から亜鉛が溶出するのをより効果的に抑制できる。Ｍｇの配合量が１．０重量部より少ないと前記効果が薄く、５．０重量部より多いと硬度が高くなり加工性が悪くなる。

【００１５】基板の表面側には下塗り層を形成するが、この下塗り層を塗装する前に基板には予めクロメート処理等の表面処理を施す。下塗り層の樹脂塗料には、エポキシ系樹脂、ポリエステル系樹脂、アクリル系樹脂、ウレタン系樹脂等を主成分とする塗料を用いる。下塗り層は乾燥塗膜厚が１～５μｍとなるように薄く焼付塗装して低コストを図るとともに、上記樹脂に防錆顔料を配合して耐食性を確保する。乾燥塗膜厚が１μｍよりも薄いと耐食性、密着性が低くなり、５μｍより厚いと塗装コスト高になる。防錆顔料は、クロム酸亜鉛、クロム酸ストロンチウム等であってもよいが、環境問題を考慮すればノンクロムの亜鉛粉末、アルミニウム粉末のような金属粉顔料、Ｃａ－シリカのようなイオン交換性顔料、リン酸塩やモリブデン酸塩のような可溶性顔料等もよい。防錆顔料の配合量は上記樹脂１００重量部に対して５～５０重量部である。なお、下塗り層２の焼付け板温度は１８０～２４０°である。

【００１６】下塗り層の上に焼付塗装される上塗り層の樹脂塗料は、フッ素樹脂に対しアクリル樹脂を配合したものを主成分とする塗料である。アクリル樹脂は、加工時のフッ素樹脂の傷付き易さを補う。フッ素樹脂は、フッ化ビニリデン樹脂、フッ化ビニル樹脂等である。フッ素樹脂１００重量部に対しアクリル樹脂の配合量が、１８重量部より少ないと上記加工性効果が劣り、１２０重量部より多いとフッ素樹脂の持つ特性が薄らぐため、フッ素樹脂１００重量部に対しアクリル樹脂を１８～１２０重量部配合したものが好ましく、より好ましくは２５～５０重量部である。

【００１７】アクリル樹脂塗料は１００％熱可塑性アクリル樹脂であってもよいが、特にフッ素樹脂の経時劣化を抑制する働きのある熱硬化性アクリル樹脂とブレンドしたものにすれば、塗装鋼板としての保管期間が長期となっても加工時の劣化防止となって有利である。熱硬化性アクリル樹脂は焼付塗装後三次元的に硬化した分子構造となり、この分子構造が経時での影響を受けにくく、フッ素樹脂の結晶の成長を抑制して小さい結晶を維持することになり、フッ素樹脂の経時劣化を抑止する。また、熱硬化性アクリル樹脂は上塗り塗膜の硬度を高めるので、プレス加工時の傷付きやブレッシャマークの発生を軽減する働きもする。熱硬化性アクリル樹脂と熱可塑性アクリル樹脂の混合比率は１０～９０：９０～１０重量％とする。この混合比率の範囲外では上記加工性とフッ素樹脂の経時劣化防止の両方の機能が十分に得られない。より好ましい混合比率は４０～６０：６０～４０重量％である。

【００１８】フッ素樹脂系塗料とアクリル樹脂系塗料の配合樹脂塗料には、セラミックファイバーを樹脂固形分１００重量部に対して０．５～３０重量部配合する。セラミックファイバーは、アルミナ、シリカ、ジルコニア等を主成分とする。セラミックファイバーの直径は２～５μｍ、セラミックファイバーの長さは５～１５０μｍである。このようなセラミックファイバーは上塗り塗膜の耐傷付き性、耐ブレッシャマーク性を向上させると共に、上塗り塗膜表面を粗くするので氷等が滑りにくくなる。セラミックファイバーを配合した上塗り塗膜表面の粗度は、Ｒａ＝０．５～２．５μｍ、Ｒｍａｘ＝１０～３０μｍとなって氷等を滑りにくくするのである。セラミックファイバーの配合量が０．５重量部より少ないと上記効果が十分に得にくくなり、３０重量部より多いと上塗り塗膜の伸びが極端に低下し折り曲げ加工性が悪くなる。より望ましいセラミックファイバーの配合量は０．５～３重量部である。

【００１９】上塗り層の乾燥塗膜厚は７～１９μｍとする。７μｍ未満では塗色によっては隠蔽性が劣り、１９μｍを越えると塗装コストアップとなる。より好ましい上塗り層の乾燥塗膜厚は１３～１７μｍである。上塗り塗料の塗装にはロール塗装を採用し、焼付け板温度は２２０～２８０°である。

【００２０】上塗り塗料には、鱗片状のアルミニウム粉やマイカ粉等を配合すれば断熱性をも付与することができる。これら鱗片状物質は、塗料１００重量部に対して２～６０重量部配合する。鱗片状物質の配合量が２重量部より少ないと断熱効果が期待できず、６０重量部より多いと上塗り塗膜の付着性が低下する。鱗片状物質の大きさは５０μｍ以下、特に２０μｍ以下であることが好ましい。２０μｍ以下であると、鱗片状物質が上塗り塗膜面と平行によくならび、これによって耐食性が向上すると共に断熱効果も向上する。５０μｍを越えると、鱗片状物質が上塗り塗膜面に平らにならばぬことにより断熱効果、耐食性効果が低減する。

【００２１】基板の裏面側には、ポリエステル樹脂系、エポキシ樹脂系、アクリル樹脂系、ウレタン樹脂系等を主成分とする塗料を焼付塗装する。この裏面塗料には防錆顔料としてストロンチウムクロメート等を配合してもよい。この裏面塗料の乾燥塗膜厚は１～１０μｍである。なお、この裏面塗装は２コートにしてもよい。

【００２２】

【実施例】実施例１

図１に本発明の実施例に係る塗装鋼板の断面構造を模式的に示す。基板１としてクロメート処理された０．４㎜厚の５５重量％Ａｌ－Ｚｎ合金溶融めっき鋼板（以下、鋼板１という。）が用いられる。鋼板１の裏面には所定の裏塗装層２が形成されている。

【００２３】鋼板１の表面には下塗り層３が形成される。下塗り層３は、防錆顔料クロム酸亜鉛を塗料１００重量部に対して３０重量部配合してなるポリエステル系樹脂塗料を、ロールにより塗装して板温２００°Ｃで焼き付け乾燥し、乾燥塗膜厚４μｍとなるように形成した。

【００２４】下塗り層３の上には上塗り層４が形成される。上塗り層４の樹脂塗料は、フッ素樹脂１００重量部に対してアクリル樹脂が８０重量部配合されたもので、このアクリル樹脂は熱可塑性アクリル樹脂：熱硬化性アクリル樹脂＝３：２の割合で配合したものである。さらに、この上塗り層４の樹脂塗料には、塗膜中にセラミックファイバーを１．９重量部配合している。この上塗り層４の樹脂塗料はロールコーターで塗装し２５０°Ｃで焼き付け乾燥し、乾燥塗膜厚が１５μｍとなるように形成される。

【００２５】次に、上記構成の塗装鋼板の製造方法の一例を図２を参照にして説明する。ロール状に巻かれた長尺の鋼板１の一端を引き出して前処理部１１に導き、この前処理部１１において鋼板１に対し脱脂、洗浄、クロメート処理等の所定の表面処理を行う。次いで、この前処理後の鋼板１を下塗り塗装部１２及び裏面塗装部１３に順次導いて、鋼板１の表面に上述した下塗り層形成用のポリエステル系樹脂塗料を塗布し、かつ、鋼板１の裏面に裏塗装を行った後、第１焼付け炉１４において板温２００°Ｃで焼き付け乾燥することにより、図１のような乾燥塗膜厚４μｍの下塗り層３と所定の裏塗装層２を形成する。さらに、この鋼板１を上塗り塗装部１５に導いて、前記下塗り層３の上に上述した上塗り層形成用の塗料を塗布し、第２焼付け炉１６において板温２５０°Ｃで焼き付け乾燥することにより、図１のような乾燥塗膜厚１５μｍの上塗り層４を形成し、最後にロール状に巻き取る。

【００２６】比較例１

下塗り層が乾燥塗膜厚７μｍのポリエステル系樹脂塗膜であり、上塗り層が乾燥塗膜厚２５μｍのフッ素樹脂系塗膜（フッ素樹脂８０重量％）である以外は、実施例１と同じである。

【００２７】比較例２

下塗り層が乾燥塗膜厚８μｍのポリエステル系樹脂塗膜であり、上塗り層が乾燥塗膜厚１５μｍのポリエステル系樹脂塗膜である以外は、実施例１と同じである。

【００２８】実施例１、比較例１，２の塗装鋼板についての氷の滑り性試験、テーバ摩耗試験、ブレッシャマーク試験、薬品性試験、及びキャス（耐食性）試験を下記の要領で実施した。

【００２９】（１）氷の滑り性試験

試験片に水を噴霧し氷を置いて２時間冷凍させた。これを室温２０°Ｃの所で試験片を２０°傾斜させて置き、氷が滑り落ちる時間を測定した。

（２）テーバ摩耗試験［ＪＩＳ　Ｋ５４００　８．９（耐摩耗性）］により試験した。テーバー形摩耗輪はＣＳ１０を用い、荷重９．８１Ｎ（１．０Kgf)を加える。

（３）耐ブレッシャマーク試験

２０Ｋｇ／㎠　×２４時間×４０°Ｃの条件で表裏塗膜同士をあわせて行った。

（４）耐薬品性試験

５％ＮａＯＨの水溶液と５％H_2SO_4の水溶液にそれぞれ２４０時間浸漬して塗膜の変色の度合いをみた。

（５）キャス（耐食性）試験［ＪＩＳ　Ｈ８６８１　５．（キャス試験方法）］ＪＩＳ　Ｈ８６８１の付図１の目視でレイティングナンバ（Ｒ．Ｎ）標準図表にて判定した。

【００３０】試験結果

各試験の結果は図３の図表に示すとおりである。上塗り層がフッ素樹脂系塗料とアクリル樹脂系塗料（熱可塑性アクリル樹脂と熱硬化性アクリル樹脂の混合物）の配合塗料でかつセラミックファイバーを所定量添加した実施例１が、上塗り層がフッ素樹脂系塗膜またはポリエステル樹脂系塗膜でセラミックファイバーを添加しない比較例１，２に比較して、とくに、氷の滑り止め性、耐摩耗性、及び耐ブレッシャマーク性に優れていることがわかるであろう。

【００３１】実施例２～４

実施例２では、基板に６重量％Ａｌ－Ｚｎ合金めっき鋼板を用い、上塗り層のアクリル樹脂を１００％熱可塑性アクリル樹脂とした以外は実施例１と同じである。実施例３では基板に６重量％Ａｌ－Ｚｎ合金めっき鋼板を用い、上塗り層のアクリル樹脂として熱可塑性アクリル樹脂と熱硬化性アクリル樹脂の混合比率を６０：４０重量％とした以外は実施例１と同じである。実施例４では基板に６重量％Ａｌ－Ｚｎ合金めっき鋼板を用い、上塗り層のアクリル樹脂として熱可塑性アクリル樹脂と熱硬化性アクリル樹脂の混合比率を４０：６０重量％とした以外は実施例１と同じである。

【００３２】実施例２～４の塗装鋼板の経時劣化試験として、初期（塗装直後）のノークラックＴ数（折り曲げ

加工性）と、６０°Ｃの雰囲気で６日間促進耐候性試験を行った後のノークラックＴ数とを調べた。この試験結果は図４に示すとおりである。上塗り層のアクリル樹脂として、熱可塑性アクリル樹脂と熱硬化性アクリル樹脂をブレンドした実施例３，４が、１００％熱可塑性アクリル樹脂を使用する実施例２よりも上塗り層の経時劣化の抑止効果に優れることがわかる。

【００３３】

【発明の効果】本発明によれば、フッ素樹脂塗装鋼板の耐候性、耐食性、耐薬品性、耐熱性等の特性を確保し得えながら、その鋼板に不足している特性、とくに傷やブレッシャマーク等が付き易く、また氷等が滑り落ち易いなどの欠点を補うことのできる外装用塗装鋼板を低コストで提供できるという利点がある。

＊【図面の簡単な説明】

【図１】本発明の実施例に係る外装用塗装鋼板を模式的に示す断面図である。

【図２】外装用塗装鋼板金属板の製造工程図である。

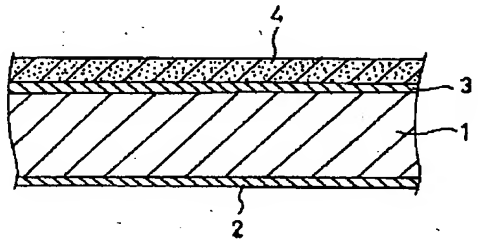
【図３】実施例１、比較例１～２についての氷の滑り性試験、テーバ摩耗試験、ブレッシャマーク試験、薬品性試験、及びキャス試験の結果を示す図表である。

【図４】実施例２～４についての経時劣化試験の結果を示す図表である。

【符号の説明】

1　基板
2　裏塗装層
3　下塗り層
4　上塗り層

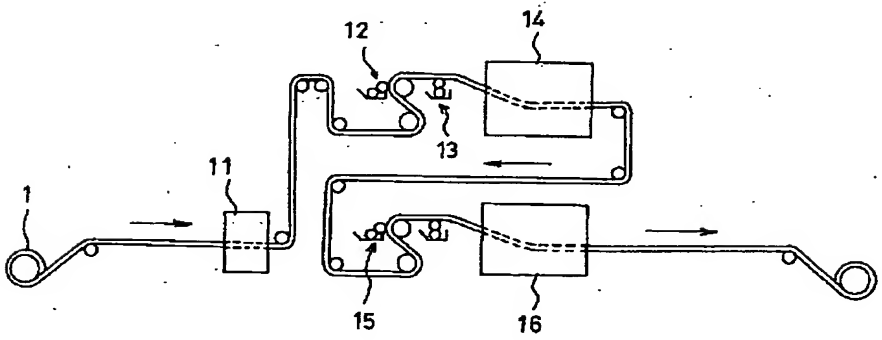
【図１】



【図４】

	実施例２	実施例３	実施例４
初期（塗装直後）	３Ｔ	３Ｔ	４Ｔ
テスト(6日間）後	７Ｔ	５Ｔ	６Ｔ

【図２】



【図３】

	実施例１	比較例１	比較例２
(1) 水の滑り性試験	15分経過滑らない	6分13秒	8分 2秒
表面粗さ Ra	1.9μm	0.3μm	0.2μm
〃 Rmax	24.4 μm	5.1μm	4.3μm
(2) テーパー摩耗試験 減摩量(mg)	14.7	19.6	24.5
(3) 耐プレッシャマーク性	異常なし	プレッシャマーク大 目視確認	プレッシャマーク中 見る角度によりよく目立つ
(4) 薬品性変色試験 5%NaOH	変色極小	変色極小	変色大（目視確認）
5%H_2SO_4	変色〃	変色〃	変色大（目視確認）
(5) キャス試験（耐食性試験）	ＲＮ9.8 以上 異常なし	ＲＮ9.8 以上 異常なし	ＲＮ8 全面ブリスター発生

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